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TABLE VIII.—*Number of days lost from school on account of sickness of known cause and number of cases of known diseases among school children 6 to 18 years of age, in certain localities in Missouri during 1919-20.*[1]

Disease.	Total school year.	1919				1920				
		September.	October.	November.	December.	January.	February.	March.	April.	May.
Days lost:										
All known diseases	14,373	98	356	793	1,176	1,764	4,008	2,528	2,533	1,117
All known diseases (exclusive of influenza)	11,832	95	356	777	1,122	1,445	2,154	2,305	2,461	1,117
Influenza	2,541	3	....	16	54	319	1,854	223	72	....
Cases:										
All known diseases	2,326	32	77	125	206	361	537	444	378	166
All known diseases (exclusive of influenza)	2,065	31	77	123	198	317	355	427	371	166
Influenza	261	1	....	2	8	44	182	17	7	....

[1] Data given here are for only the small part of the total absence from sickness in which the specific disease was reported.

TABLE IX.—*Number of days lost from school on account of sickness of known cause and number of cases of each known disease causing absence among children 6 to 18 years of age, in certain localities in Missouri during 1919-20.*[1]

Disease.	Days lost.			Cases.		
	All ages (6 to 18).	6 to 10 years of age.	11 to 18 years of age.	All ages (6 to 18).	6 to 10 years of age.	11 to 18 years of age.
All known diseases	14,373	9,523	4,850	2,326	1,376	950
All known diseases (exclusive of influenza)	11,832	8,001	3,831	2,065	1,231	834
Influenza	2,541	1,522	1,019	261	145	116
Cold	3,843	2,273	1,570	1,177	650	527
Measles	2,785	2,290	495	251	205	46
Mumps	1,512	955	557	213	134	79
Scarlet fever	891	659	232	59	40	19
Whooping cough	516	506	10	22	21	1
Chicken pox	427	333	94	55	43	12
Tonsillitis	305	113	192	49	16	33
Toothache	275	129	146	126	61	65
Pneumonia	269	177	92	14	8	6
Diphtheria	96	42	54	6	3	3
Smallpox	58	43	15	4	3	1
Other diseases	855	481	374	89	47	42

[1] Data given here are for only the small part of the total absence from sickness in which the specific disease was reported.

DISINFECTANT TESTING BY THE HYGIENIC LABORATORY METHOD.

The following method for determining the phenol coefficient of disinfectants supersedes the methods described in previous publications of the Public Health Service and is the present Hygienic Laboratory method.

No single method can serve as a means of comparing the value in practice of disinfectants of greatly diverse composition and destined for a variety of applications. However, disinfectants which are chemically related to phenol, which are to be used against organisms reacting similarly to the manner in which the typhoid bacillus reacts and which are destructive within the time and temperature limits of this test, may be compared as to their disinfecting properties within these limitations by means of this test. The results may be useful in the selection of a potent product, in making comparisons of cost in terms of service rendered, and in checking successive batches of the same product.

This method was submitted to several different laboratories for trial before its adoption, and the results seem to justify the belief that the personal equation in the performance of the tests does not play an inordinate rôle.

THE TEST CULTURE.

The test culture is a culture of *Bacillus typhosus*, Hopkins strain. Between periods of testing it is maintained on nutrient agar stabs, transferred at monthly intervals.

For at least 5 days before the test the culture is transferred at 24-hour intervals to successive tubes of the meat extract broth described below and incubated at 37° C. Transfers are made with one standard loopful. The culture is filtered through sterile filter paper just before using. The test is performed with a 24-hour culture.

THE PHENOL.

The phenol must comply with the requirements of the Eighth United States Pharmacopoeia. Particularly the congealing point must not be below 40° C. The crystals are kept in tightly stoppered amber-colored bottles in a dark and relatively cool place.

A 5 per cent original solution is made by adding 1 part by weight of phenol, liquefied by warming the bottle, to 19 parts of distilled water. A fresh solution is made for each day's use.

THE CULTURE MEDIUM.

Make meat extract medium as follows:

Beef extract (Liebig's)	3 gm.
Peptone (Armour's for disinfectant testing)	10 gm.
Sodium chloride	5 gm.
Water, distilled	1,000 c. c.

Boil for 15 minutes.
Make up to original weight by addition of water.
Filter through paper.
Tube, 10 c. c. to each tube.
Sterilize.
The p_H value of this medium should be between 6.0 and 7.0.

GLASSWARE AND APPARATUS.

Glassware for measuring must be accurately graduated. It must be clean, dry, and sterile at the time of use. There will be needed—

1 c. c. capacity pipettes.
5 c. c. capacity pipettes.
1 c. c. delivery pipettes, graduated in tenths.
5 c. c. delivery pipettes.
100 c. c. measuring cylinders, graduated in 1 c. c., glass stoppered.
Seeding tubes, 1 x 3 inches, flared tops, round bottoms.

Racks consisting of blocks of wood with rows of holes for both the seeding tubes (before they are placed in the water bath) and the subculture tubes.

Wire loops must be carefully made and kept from damage. They are made as follows: A close cylindrical spiral is made by winding a piece of platinum wire, No. 23, B. & S. gauge, as tightly as possible about a piece of steel or other hard wire having a diameter of 0.072 inch (No. 13, B. & S. gauge) to complete a little more than four full turns. The long end of the wire is then bent sharply at right angles to the wound portion and parallel to the steel wire. The core is removed and the short end of the wire is clipped off so as to leave exactly four full turns to the coil. The successive turns of the spiral must touch one another continuously. The long end of the wire is attached to an aluminum handle.

A convenient support is provided on which to rest the loops so that a batwing Bunsen burner may be placed under each one successively.

A constant temperature bath is provided, capable of maintaining the seeding tubes at 20° C. during the time of the test. A well-insulated bath of large volume relative to the surface exposed is sufficient without thermoregulating appliances.

Disinfectant testing machine.—The use of a disinfectant testing machine is optional. One is described in Reprint No. 462 from the Public Health Reports. A few modifications have proved useful. For example, the use of platinum instead of nichrome loops, and the practice of sterilizing the subculture tubes covered with padded inverted troughs in the racks.

DILUTIONS.

Dilutions of phenol and of disinfectants are made from the original liquid on the day of the test. For the dilutions of the disinfectant, a 5 per cent solution is made by adding 5 c. c. of the disinfectant to 95 c. c. of sterile distilled water. A standardized 5 c. c. capacity pipette is used for this purpose. After filling the pipette, all excess of the disinfectant on the outside of the pipette is wiped off with sterile gauze. The contents of the pipette are then delivered into a cylinder containing 95 c. c. of sterile distilled water and the pipette is washed out as clean as possible by aspiration and blowing out the contents into the cylinder. The contents of the cylinder are then thoroughly shaken and the dilutions up to 1:500 are made from it, using delivery pipettes for measuring. For those disinfectants which do not readily form a 5 per cent solution, make a 1 per cent solution, and from this make the dilutions greater than 1:100 in accordance with the second table of dilutions. If greater dilutions than 1:500 are to be made, a 1 per cent solution is made from the 5 per cent solution and the higher dilutions are made from this.

For the higher dilutions, delivery pipettes may be used. The following scale is used for making dilutions:

> For dilutions up to 1:70, increase or decrease by a difference of 5 (i.e., 5 parts of water); from 1:70 to 1:160, by a difference of 10; from 1:160 to 1:200, by a difference of 20; from 1:200 to 1:400, by a difference of 25; from 1:400 to 1:900, by a difference of 50; from 1:900 to 1:1800, by a difference of 100; from 1:1800 to 1:3200, by a difference of 200; and so on if higher dilutions are necessary.

It is important that the cylinders used for making the dilutions be correctly graduated. It is preferable to use standardized cylinders and pipettes. For making the dilutions in accordance with the above scheme, the following tables are of service:

Tables useful in making dilutions.

[5 c. c. of disinfectant + 95 c. c. of distilled water = Solution A.]

Dilution.		c. c. of A.		c. c. of dist. water.		c.c. of A.		c. c. of dist. water.		c.c. of A.		c. c. of dist. water.
1:20	=	20	+	0	or	10	+	0	or	4	+	0
1:25	=	20	+	5	or	10	+	2½	or	4	+	1
1:30	=	20	+	10	or	10	+	5	or	4	+	2
1:35	=	20	+	15	or	10	+	7½	or	4	+	3
1:40	=	20	+	20	or	10	+	10	or	4	+	4
1:45	=	20	+	25	or	10	+	12½	or	4	+	5
1:50	=	20	+	30	or	10	+	15	or	4	+	6
1:55	=	20	+	35	or	10	+	17½	or	4	+	7
1:60	=	20	+	40	or	10	+	20	or	4	+	8
1:65	=	20	+	45	or	10	+	22½	or	4	+	9
1:70	=	20	+	50	or	10	+	25	or	4	+	10
1:70	=	20	+	50	or	10	+	25	or	4	+	10
1:80	=	20	+	60	or	10	+	30	or	4	+	12
1:90	=	20	+	70	or	10	+	35	or	4	+	14
1:100	=	20	+	80	or	10	+	40	or	4	+	16
1:110	=	20	+	90	or	10	+	45	or	4	+	18
1:120	=	20	+	100	or	10	+	50	or	4	+	20
1:130	=	20	+	110	or	10	+	55	or	4	+	22

Dilution.		c. c. of A.		c. c. of dist. water.		c.c. of A.		c. c. of dist. water.		c.c. of A.		c. c. o. of dist. water
1:140	=	20	+	120	or	10	+	60	or	4	+	24
1:150	=	20	+	130	or	10	+	65	or	4	+	26
1:160	=	20	+	140	or	10	+	70	or	4	+	28
1:170	=	20	+	150	or	10	+	75	or	4	+	30
1:180	=	20	+	160	or	10	+	80	or	4	+	32
1:200	=	20	+	180	or	10	+	90	or	4	+	36
1:200	=	20	+	180	or	4	+	36	or	2	+	18
1:225	=	20	+	205	or	4	+	41	or	2	+	20½
1:250	=	20	+	230	or	4	+	46	or	2	+	23
1:275	=	20	+	255	or	4	+	51	or	2	+	25½
1:300	=	20	+	280	or	4	+	56	or	2	+	28
1:325	=	20	+	305	or	4	+	61	or	2	+	30½
1:350	=	20	+	330	or	4	+	66	or	2	+	33
1:375	=	20	+	355	or	4	+	71	or	2	+	35½
1:400	=	20	+	380	or	4	+	76	or	2	+	38
1:450	=	20	+	430	or	4	+	86	or	2	+	43
1:500	=	20	+	480	or	4	+	96	or	2	+	48

Tables useful in making dilutions—Continued.

[1 c. c. of disinfectant + 99 c. c. of distilled water = Solution B.

Dilution.	c. c. of B.	c. c. of dist. water.	c. c. of B.	c. c. of dist. water.	c. c. of B.	c. c. of dist. water.
1:100 =	100 +	0	or 10 +	0		
1:110 =	100 +	10	or 10 +	1		
1:120 =	100 +	20	or 10 +	2		
1:130 =	100 +	30	or 10 +	3		
1:140 =	100 +	40	or 10 +	4		
1:150 =	100 +	50	or 10 +	5		
1:160 =	100 +	60	or 10 +	6		
1:160 =	100 +	60	or 10 +	6		
1:180 =	100 +	80	or 10 +	8		
1:200 =	100 +	100	or 10 +	10		
1:200 =	100 +	100	or 10 +	10	or 4 +	4
1:225 =	100 +	125	or 10 +	12½	or 4 +	5
1:250 =	100 +	150	or 10 +	15	or 4 +	6
1:275 =	100 +	175	or 10 +	17½	or 4 +	7
1:300 =	100 +	200	or 10 +	20	or 4 +	8
1:325 =	100 +	225	or 10 +	22½	or 4 +	9
1:350 =	100 +	250	or 10 +	25	or 4 +	10
1:375 =	100 +	275	or 10 +	27½	or 4 +	11
1:400 =	100 +	300	or 10 +	30	or 4 +	12
1:400 =	10 +	30	or 4 +	12	or 2 +	6
1:450 =	10 +	35	or 4 +	14	or 2 +	7
1:500 =	10 +	40	or 4 +	16	or 2 +	8
1:550 =	10 +	45	or 4 +	18	or 2 +	9
1:600 =	10 +	50	or 4 +	20	or 2 +	10
1:650 =	10 +	55	or 4 +	22	or 2 +	11
1:700 =	10 +	60	or 4 +	24	or 2 +	12
1:750 =	10 +	65	or 4 +	26	or 2 +	13
1:800 =	10 +	70	or 4 +	28	or 2 +	14
1:850 =	10 +	75	or 4 +	30	or 2 +	15
1:900 =	10 +	80	or 4 +	32	or 2 +	16
1:900 =	5 +	40	or 4 +	32	or 2 +	16
1:1,000 =	5 +	45	or 4 +	36	or 2 +	18
1:1,100 =	5 +	50	or 4 +	40	or 2 +	20
1:1,200 =	5 +	55	or 4 +	44	or 2 +	22
1:1,300 =	5 +	60	or 4 +	48	or 2 +	24
1:1,400 =	5 +	65	or 4 +	52	or 2 +	26
1:1,500 =	5 +	70	or 4 +	56	or 2 +	28
1:1,600 =	5 +	75	or 4 +	60	or 2 +	30
1:1,700 =	5 +	80	or 4 +	64	or 2 +	32
1:1,800 =	5 +	85	or 4 +	68	or 2 +	34
1:1,800 =	5 +	85	or 4 +	68	or 2 +	34
1:2,000 =	5 +	95	or 4 +	76	or 2 +	38
1:2,200 =	5 +	105	or 4 +	84	or 2 +	42
1:2,400 =	5 +	115	or 4 +	92	or 2 +	46
1:2,600 =	5 +	125	or 4 +	100	or 2 +	50
1:2,800 =	5 +	135	or 4 +	108	or 2 +	54
1:3,000 =	5 +	145	or 4 +	116	or 2 +	58
1:3,200 =	5 +	155	or 4 +	124	or 2 +	62

METHOD.

This description applies to the hand method. For the use of the machine, follow the procedure of Reprint No. 462 from the Public Health Reports.

The object is to add 0.1 c. c. of typhoid culture to 5 c. c. of successive dilutions of the disinfectant and of phenol, and, after this addition, to transfer a loopful of each mixture to a separate subculture tube at periods of 5, 7½, 10, 12½, and 15 minutes. The subculture tubes are then incubated for 48 hours at 37° C., and readings of growth or no growth are made and recorded.

Dilutions are made to cover the expected range of the disinfectant, and 5 c. c. of each dilution is placed in a seeding tube. Dilutions of phenol are made as follows: 1:80, 1:90, 1:100, 1:110, 1:120, and 1:130, and 5 c. c. of each is placed in a seeding tube.

The seeding tubes are placed in the water bath at 20° C. and a few minutes are allowed for their contents to reach this temperature.

To each seeding tube 0.1 c. c. of culture is then added seriatim, allowing 15 seconds for each addition. If there are 10 tubes of disinfectant dilutions, this will occupy 2½ minutes. At the end of 5 minutes from the time of adding the disinfectant to the first seeding tube, a oopful of the mixture is transferred from this tube to a subculture tube, and this is done from each successive seeding tube at 15-second intervals. This procedure is repeated after the lapse of 7½, 10, 12½, and 15 minutes from the time of the first addition of culture to the seeding tube. Each loop is placed on the support and flamed with the Bunsen burner immediately after use, and the use of several loops permits them to cool before they are needed again. The operator is therefore obliged to make a transfer every 15 seconds for 10 minutes.

The culture is best added to the seeding tube by holding the latter in a slanting position and touching the tip of the 1 c. c. pipette to the wetted surface exposed on its upper side. One-tenth c. c. is run in at the proper time and thorough admixture is assured by gentle shaking.

The dilutions of phenol are next treated in the same manner as those of the disinfectant.

The tubes are properly labeled and are placed in the incubator for 48 hours, at the end of which time readings of growth or no growth are made and entered in a table as + or − signs, respectively.

In the nature of the test it is unavoidable that discrepancies in the even oblique slant of the plus signs across the chart will occasionally be encountered; but if these are numerous, a faulty technique is indicated and the test should be discarded. The same applies to accidentally contaminated tubes.

DETERMINATION OF COEFFICIENT.

The coefficient is the arithmetic mean of the sum of three ratios, expressed decimally. These ratios are, the denominator of the highest dilution of the disinfectant in whose subculture tube no growth occurs, divided by the corresponding figure for phenol, for the 5, 10, and 15 minute intervals, respectively.

Example:

Sample.	Dilution.	Time of exposure in minutes.				
		5	7½	10	12½	15
Disinfectant	1 : 700	−	−	−	−	−
	1 : 800	+	−	−	−	−
	1 : 900	+	+	−	−	−
	1 : 1,000	+	+	+	+	−
	1 : 1,100	+	+	+	+	+
Phenol	1 : 80	−	−	−	−	−
	1 : 90	+	−	−	−	−
	1 : 100	+	+	+	+	−
	1 : 110	+	+	+	+	−
	1 : 120	+	+	+	+	+
	1 : 130	+	+	+	+	+

$$\text{Coefficient}=\frac{\frac{700}{80}+\frac{900}{90}+\frac{1000}{110}}{3}=\frac{8.7+10.0+9.0}{3}=9.2$$